

A REVISION OF THE *CHARYBDIS MILES* "GROUP" OF SPECIES
(CRUSTACEA: PORTUNIDAE), WITH DESCRIPTION OF A NEW
SPECIES FROM QUEENSLAND WATERS

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A dried specimen of *Charybdis*, which had been collected from fairly deep waters off southern Queensland, proved to be close to, but distinct from, *C. riversandersoni* Alcock. It is here described as *C. rufodactylus* n. sp. As already noted by Stephenson and Rees (1967) and by Stephenson (1967), *C. riversandersoni* and *C. miles* (de Haan) resemble each other more closely than might be expected from Leene's (1938) monograph, and the discovery of the new species gave sufficient homogeneity to the three species for them to be regarded as a closely related "group".

In comparing similarities and differences between the three species it became evident that *C. riversandersoni* in particular showed unexpected variability, and additional material was variously borrowed. This revealed that part of the variation was due to confusion between *C. riversandersoni* and *C. sagamiensis* Parisi, and that the latter species, which had been synonymised with the former, merits independent status.

Because of the difficulties in identifying species in this group, past records which omit structural features may have been referred to the wrong species. In cases where confirmation was not obtained by examination of specimens, such records are indicated in the synonymy by:—"(record only)".

Dimensions were measured by dial calipers to the nearest 0.1 mm. Breadths of specimens include the last anterolateral teeth, and are given only to the nearest 0.5 mm. Carapace lengths were measured in the midline from the base of the notch between the median frontal teeth to the centre of the posterior margin of the carapace. Breadth/length ratios of carapaces varied, and this variation appeared to be mostly at an individual level, rather than being size dependent. Only mean breadth/length ratios of carapace are given.

Breadths of fifth legs were measured in the widest portions proximal to the posterolateral spines. Length/breadth ratios were shown to vary with the species, and also with the size of the specimen, and hence in the specific descriptions there is a deliberate lack of precision. The relevant data are given in fig. 3.

***Charybdis miles* (de Haan)**

(Figs. 1A, 1E, 2A; pl. 12A)

Portunus (Charybdis) miles de Haan, 1835, p. 41, pl. 11, fig. 1.

Charybdis miles (de Haan). Stimpson, 1858, p. 39. Whitelegge, 1900, p. 157. Doflein, 1902, p. 659. Rathbun, 1902, p. 27. Stimpson, 1907, p. 82. Parisi, 1916, p. 175. Balss, 1922, p. 104. Yokoya, 1933, p. 195 (record only). Sakai, 1934, p. 302; 1936, p. 123, pl. 33, fig. 2; 1939, p. 405, pl. 46, fig. 2; 1965, p. 123, pl. 61. Stephenson, 1967, p. 11. Stephenson and Rees, 1967b, p. 6.

Goniosoma miles (de Haan). A. Milne Edwards, 1861, pp. 378, 385. Ortmann, 1893, p. 81 (record only).

Charybdis (Goniosoma) miles (de Haan). Alcock, 1899, pp. 62–3. Chopra, 1935, p. 485, fig. 9. Shen, 1937, p. 123, fig. 13.

Charybdis (Gonioneptunus) investigatoris Alcock, 1899, p. 70. Alcock and Anderson, 1900, pl. 46, fig. 4.

Charybdis (Charybdis) miles (de Haan). Leene, 1938, pp. 38–43, figs. 10–13. Stephenson, Hudson and Campbell, 1957, pp. 500–1, figs. 2H, 3I, pl. 2, fig. 3, pl. 4F. Rees and Stephenson, 1966, p. 37. Stephenson and Rees, 1967a, p. 11.

MATERIAL EXAMINED

From Queensland Museum, Brisbane: Male (54 mm), Arnhem Bay, N. Territory, 10 fm, sand and mud bottoms, coll. V. Wells, W2431; male (83 mm*), female (59.5 mm) trawled 40 miles N. of Cape Moreton, Qd, 62 fm, coll. Zool. Dept Univ. Qd, 10/viii/1966, W2784.

From Dr. T. Sakai: 4 females, Sagami Bay, 30–50 m, Qd Mus. W 2783.

From Australian Museum, Sydney: 7 males (36.5–60 mm), 3 females (38.5–57 mm). "Thetis" Stas. 21, 24, 25, Newcastle Bight, N.S. Wales, 28–40 fm, E. R. Waite, G2170, G2210, G2355; 4 males (37–66 mm), female (46 mm), "Thetis" Sta. 22, Newcastle Bight, N.S. Wales, 26–40 fm, E. R. Waite, G2352; female (64 mm), off Botany Bay, N.S. Wales, deep water, from deck and nets of trawler "Thistle", pres. M. Ward, Oct., 1924, P7870. Male (38.5 mm), Stockton Bight, N.S. Wales, 75 fm, trawled in association with prawns, A. A. Racek, Feb. 1960, P14188; ovig. female (69 mm), "Kestrel" Sta. 6, Southern Gulf of Carpentaria, Qd, C.S.I.R.O. Prawn Survey, 1963–64, P14847; male (51.5 mm), trawled 13 miles off Clarence River mouth, N.S. Wales, 34–40 fm, F. Ellen, March 1965, P15167.

From Smithsonian Oceanographic Sorting Centre, International Indian Ocean Expedition Collections: Male (52 mm), ovig. female (47.5 mm), "Anton Bruun" Cr. 1, Sta. AB–20, 09° 13' N., 95° 51' E., trawled, 60–58 m, 23/iii/1963; male (51.5 mm), "Anton Bruun" Cr. 1, Sta. AB21–63, 09° 54' N., 97° 42' E., trawled, 70 m, 24/iii/1963; male (26.5 mm), female (28 mm), "Anton Bruun" Cr. 4B, Sta. 255A, 25° 50' N., 57° 07' E. – 25° 45' N., 57° 07' E., trawled 92–95 m, clay, mud, sand, minute gastropod shells, 30/xi/1963; 4 males (21.5–54 mm), ovig. female (47.5 mm), "Anton Bruun" Cr. 4B, Sta. 256A, 26° 10' N., 57° 02' E. – 26° 13' N., 57° 02' E., trawled, 64–55 m, green mud, 30/xi/1963; female (54.5 mm), "Anton Bruun" Cr. 4B, Sta. 261A, 25° 52' N.,

56° 53' E. – 25° 53' N., 56° 53' E., trawled, 99 m, green mud with few small shells, 1/xii/1963; male (81.5 mm[†]), female (30.5 mm), "Anton Bruun" Cr. 4B, Sta. 262A, 25° 37' N., 56° 34' E. – 25° 39' N., 56° 34' E., trawled, 79 m, green muddy sand, 1/xii/1963.

From Smithsonian Institution, U.S.N.M.: Male (84 mm), Dale, Palos, Bore I., received 19/xii/1881 (Japan), 5259; 2 males (58.5, 84.5 mm), ovig. female (51 mm), Wakanoura, Kii, Japan. Jordan and Snyder, Stanford University 1900, 26261; male (55 mm), Tomaga Shima Lt. bet. Kobe and Yokohama, Sta. 4964, 37 fm, 27/viii/1906, 50794; male (31.5 mm), Mogi, Japan, exch. Imperial University, Tokyo, 45855; male (74 mm), China, S. F. Light, 61977; ovig. female (61.5 mm), San Andreas I. bet. Marinduque and Luzon, Sta. 5220, 50 fm, 24/iv/1908, *Albatross Philippine Exped.*, 50792; juv. female (21.5 mm), San Fernando Pt., W. coast Luzon, P.I., Sta. 5442, 45 fm, coarse sand, 16° 30' 36" N., 120° 11' 06" E., 11/v/1909, *Albatross Philippine Exped.*, 112310 (rounded frontal teeth).

From Scripps Institution of Oceanography: 2 males (54.5, 60 mm), "Naga" Sta. 59-0052, Gulf of Siam, 08° 40' N., 102° 18.5' E., 70 m, trawled, 24/x/1959, Cat. No. 43-0144; female (56.5 mm), "Naga" Sta. 60-0212, S. China Sea, 15° 40' N., 109° 22.9' E., 60-108 fm, trawled, 27/ii/1960, Cat. No. 43-00115; male (22.5 mm), *Sacculina* infected specimen (27 mm), "Naga" Sta. 60-0237, Hon Lon, Viet Nam, 12° 09.7' N., 109° 24.7' E., 91-101 m, trawled, 4/iii/1960, Cat. No. 43-00129; male (53 mm), "Naga" Sta. 60-0636, Gulf of Siam, 10° 19.8' N., 102° 25.8' E., 62 m, trawled, 7/viii/1960, Cat. No. 43-00147; female (48 mm), "Naga" Sta. 60-0777, S. China Sea, 12° 09.7' N., 109° 24' E., 93 m, trawled, 20/ix/1960, Cat. No. 43-00150.

From Zoologisch Museum, Amsterdam: Ovig. female (65.5 mm), "Siboga" Sta. 318, 06° 36.5' N., 114° 55.5' E., 88 m.

From British Museum: Male (87.5 mm), Tosa Bay, Japan, K. Sakai, 1961, 6.5.63; male (48 mm), female (46.5 mm), Tanabe Bay, Japan, Mr. Yamamoto, Seto Marine Lab., 1961, 11.13.39/40; male (67 mm), Hong Kong, Barney, 1930, 12.2.102 (prev. ident. by J. E. Leene); 2 females (47.5, 52.5 mm), Newcastle Bight, N.S. Wales, Australia, 28-40 fms., pres. Australian Museum, 1912, 11.22.66/67 (prev. ident. by T. Whitelegge).

MATERIAL ILLUSTRATED

Figs. 1A, 2A, specimen † above. Pl. 12A, specimen * above.

DESCRIPTION

FRONT: Six toothed, with medians and submedians relatively stout and acutely or roundedly triangular, and laterals narrow and acute. Medians separated by relatively shallow fissure, pointing directly forwards. Submedians separated from medians by broad shallow fissure, inclined laterally particularly inner borders. Laterals, separated from submedians by moderately wide fissure, directed forwards. Inner supraorbital angles moderately sharp but stout, inner supraorbital fissure widely open, outer fissure barely open. General suborbital border granular. Suborbital fissure very wide and deep.

ANTEROLATERAL TEETH: Six; first relatively short with truncate sometimes almost bifid margin; second to fifth broad-based, sharp-tipped, with anterior borders concave, and with third and fourth slightly larger than second and fifth. Sixth relatively short, directed somewhat forwards and slightly upwards.

CARAPACE: Relatively narrow (mean B/L 1.44), with fine pile through which well-developed granular ridges visible, beneath pile some granular patches. Posterolateral borders long and very little inclined. Postlateral junction rounded. Branchial regions at most very slightly swollen. Granular ridges as follows: frontal just recognisable; protogastrics of moderate length, widely separated, almost straight; mesogastrics almost straight; metogastrics narrowly separated in midline and almost straight; epibranchials conspicuous, moderately curved. Fine diffuse granular patches as follows visible after removal of pile: on bases of frontal teeth; sometimes small patches behind frontal ridges; between protogastrics and mesogastrics; on mesobranchial regions; on bases of first to fifth anterolateral teeth. Posterior part of cervical grooves fairly widely separated, moderately distant from metagastric ridges.

CHELIPEDS: Long, spinous, upper surfaces densely hirsute, hand slightly swollen. Arm with anterior border bearing 3–5 spines which are curved, sharp and either slender or robust; upper surface mostly fairly coarsely granular; under surface granular on projecting portion, terminating in boss with spine or tubercle. Wrist with inner and three outer spines; inner spine long; carinae running to inner spine and to upper and lower of three outer spines. Upper surface of hand with four sharp spines including one at wrist articulation, one near centre of outer margin, and two on inner margin (one roughly at middle, one on distal border); outer surface with central carina very well-developed and composed of fused granules, above this well-developed squamiform markings, these sometimes also below carina; under surface strongly squamiform; inner surface with strongly developed central carina with conspicuous squamiform markings on areas above and below carina. Movable finger long, slender and deeply grooved. Immobile finger with inner and outer surfaces as movable finger; under surface deeply grooved.

WALKING LEGS: Moderately long and slender, for example carpus of last walking leg moderately elongate and narrow.

FIFTH LEG: Merus fairly broad (see fig. 3); spine on posterodistal border. Propodus with 0–5 typically 2 spinules on posterodistal border.

MALE ABDOMEN: Penultimate segment broader than long. Ultimate segment of moderate length.

MALE FIRST PLEPOD: Sinuous, without obvious membrane. Subterminal armature: inner side, short bristles to aperture; outer side, relatively short row of long bristles, with concentration just behind tip, thereafter sparse.

PIGMENTATION (recently preserved specimens): Features common to all four species are separately listed (see p. 106). Distinctive features are:—movable finger, upper and inner surface, proximal half pale pink and white, distal half pink; outer surface cream becoming pale pink near tip, or with mottled or barred pink and white.

Immovable finger, outer surface, proximal half to two-thirds cream or pink, remainder pale pink to red, this extending backwards almost to level of articulation of movable finger; inner surface, proximal one-third to half mostly cream with pink or red distal area.

COMMENTS

This species differs considerably from the remainder, and possesses the following distinctive features apart from pigmentation:

- (1) Median frontal teeth separated by relatively shallow fissure.
- (2) Suborbital fissure very wide and deep.
- (3) Sixth anterolateral tooth relatively short.
- (4) Carapace relatively narrow, with fine pile.
- (5) Upper surfaces of chelipeds densely hirsute.
- (6) Hand of cheliped with under surface strongly squamiform, and squamiform markings on inner surface above and below central carina.
- (7) Immovable finger with under surface deeply grooved.
- (8) Fifth leg with relatively broad merus.
- (9) Male first pleopod, subterminal armature on outer side with relatively short row of long bristles with concentration behind tip.

Distribution is from the Gulf of Oman, India, Singapore, and Japan, to the Philippines and Australia.

***Charybdis riversandersoni* Alcock**

(Figs. 1B, 1F, 2B, 2D; pl. 12B)

Charybdis (Goniosoma) riversandersoni Alcock, 1899, p. 53. Alcock and McArdle, 1902, pl. 40, fig. 3. Gordon, 1931, p. 538, fig. 13c (under *C. (G.) barneyi*).

Charybdis (Charybdis) riversandersoni Alcock. Leene, 1938, pp. 28–30, figs. 3, 4a, 4b.

Charybdis riversandersoni Alcock. Stephenson, 1967, p. 12. Stephenson and Rees, 1967b; pp. 7–8.

[non] *Charybdis riversandersoni* Alcock. Balss, 1922, p. 105. Sakai, 1939, pp. 404–5, pl. 46, fig. 1; 1965, pp. 122–3, pl. 60, fig. 2. (= *C. sagamiensis* Parisi).

MATERIAL EXAMINED

From Smithsonian Oceanographic Sorting Center, International Indian Ocean Expedition Collections: Female (26 mm), "Anton Bruun" Cr. 4B, Sta. 202 A, 17° 25' N., 71° 39' E. – 17° 21' N., 71° 41' E., trawled, 96–106 m, greenish sand and mud, 13/xi/1963. 2 males (65.5†, 75.5* mm), "Anton Bruun", Cr. 4B, Sta. 263 A, 25° 12' N., 56° 47' E. – 25° 12' N., 56° 51' E., trawled, 206 m, grey soft mud, 2/xii/1963. Male (18.5 mm), 2 females (26, 34.5 mm), one extra cheliped, "Anton Bruun" Cr. 4B, Sta. 264 A, 25° 02' N., 56° 52' E. – 25° 08' N., 56° 52' E., trawled, 291–272 m, sticky grey clay and mud, 2/xii/1963.

From Scripps Institution: Male (67 mm), damaged female (42.5 mm), "Naga" Sta. 60–0212, S. China Sea, 15° 40' N., 109° 22.9' E., 60–108 fm, trawled, 27/ii/1960, Cat. No. 43–00116.

From British Museum: Male (61.5 mm), 7° 27' N., 71° 41' E., pres. Indian Museum, 99 : 8 : 26 : 2.

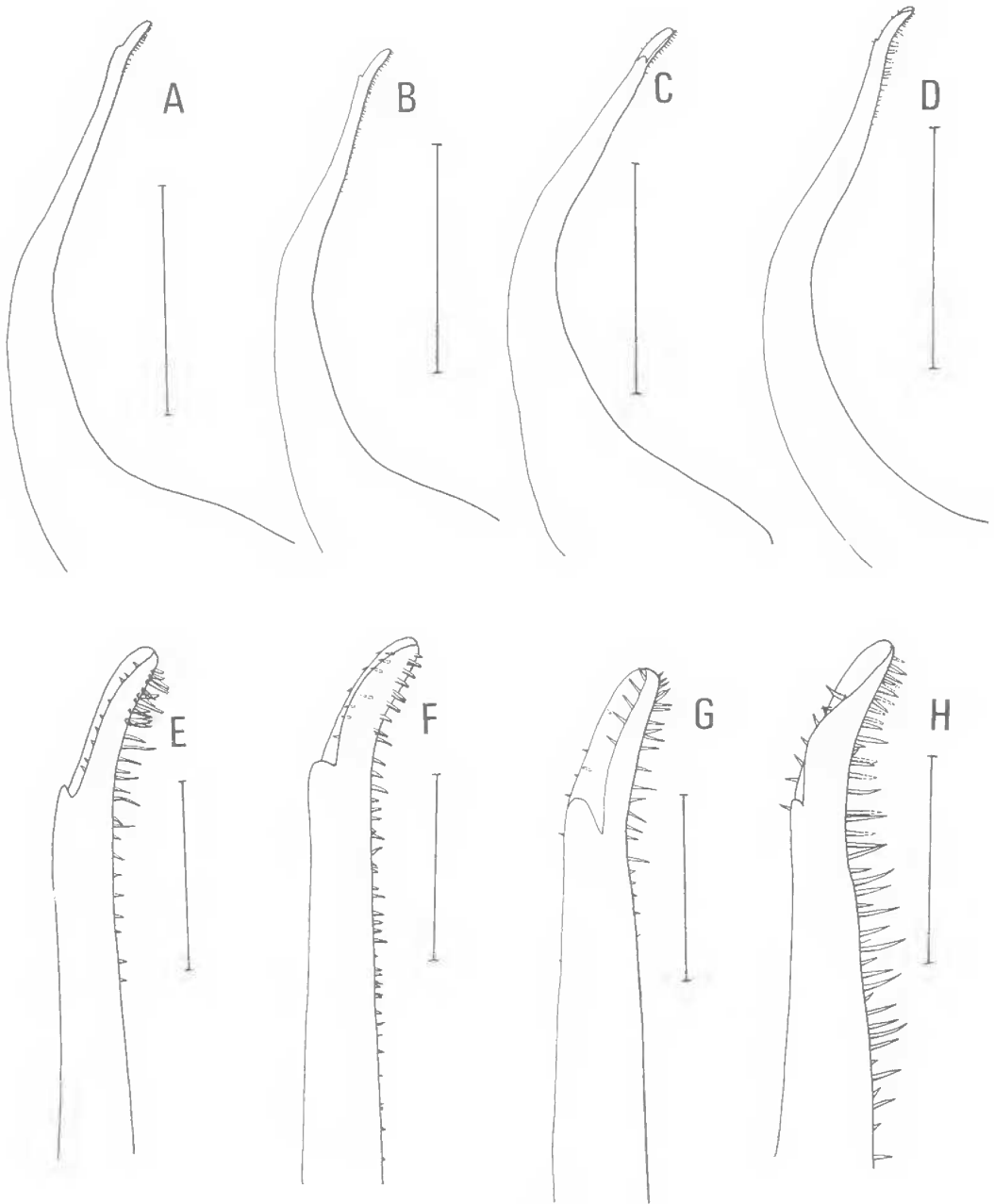


FIG. 1: Male first pleopods, upper view, A-D whole pleopods (scale 5 mm), E-H tips of pleopods (scale 1 mm). A, *Charybdis miles*; B, *C. riversandersoni*; C, *C. sagamiensis*; D, *C. rufodactylus*; E, *C. miles*; F, *C. riversandersoni*; G, *C. sagamiensis*; H, *C. rufodactylus*.

MATERIAL ILLUSTRATED

Pl. 12B and Figs. 1B, 1F and 2B, specimen * above. Fig. 2D, specimen † above.

DESCRIPTION

FRONT: Six toothed, with medians and submedians relatively stout, laterals narrow, elongate and acute. Medians separated by moderately deep fissure, roundedly triangular, pointing directly forwards and slightly narrower than submedians. Submedians separated from medians by relatively broad fissure, triangular with pointed tips, and inclined laterally. Laterals separated from submedians by moderately wide fissure, pointing directly forwards or inclined a little medianly. Inner supraorbital angles moderately sharp but stout. Inner supraorbital fissure widely open; outer fissure barely open. General suborbital border granular. Suborbital fissure wide.

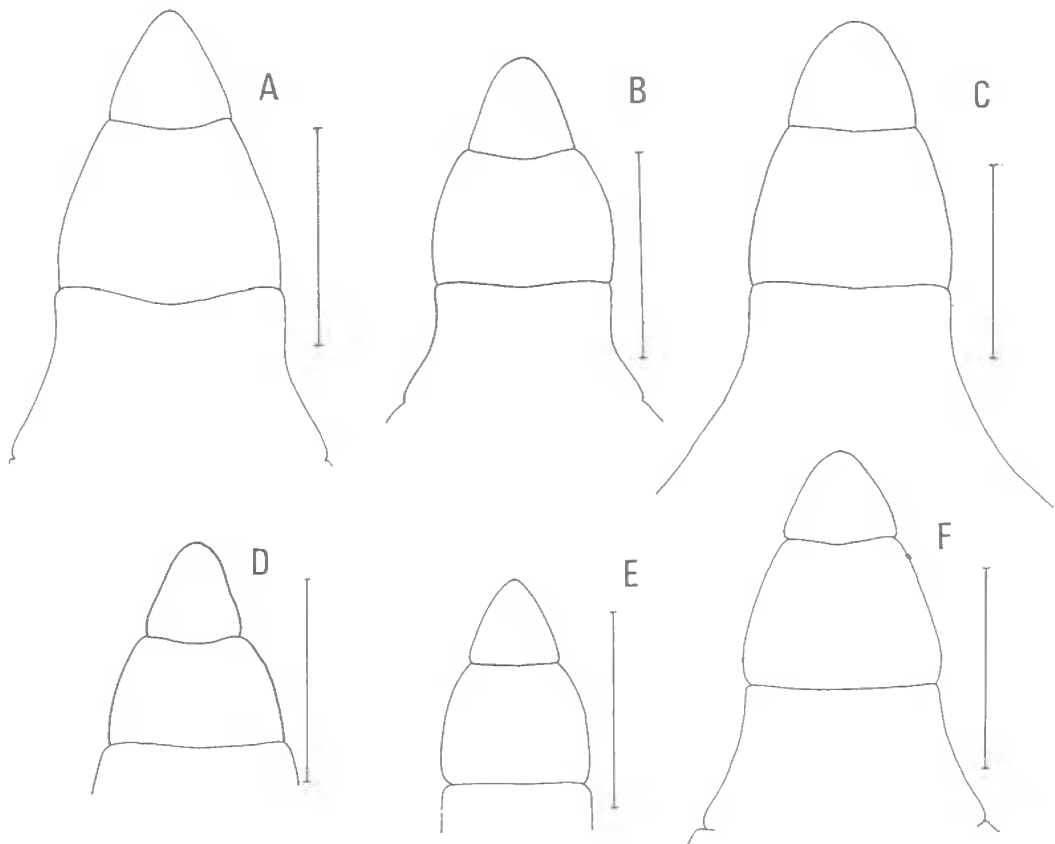


FIG. 2: Male abdomens (scale 10 mm). A, *C. miles*; B, *C. riversandersoni*; C, *C. sagamiensis*; D, *C. riversandersoni*; E, *C. sagamiensis*; F, *C. rufodactylus*.

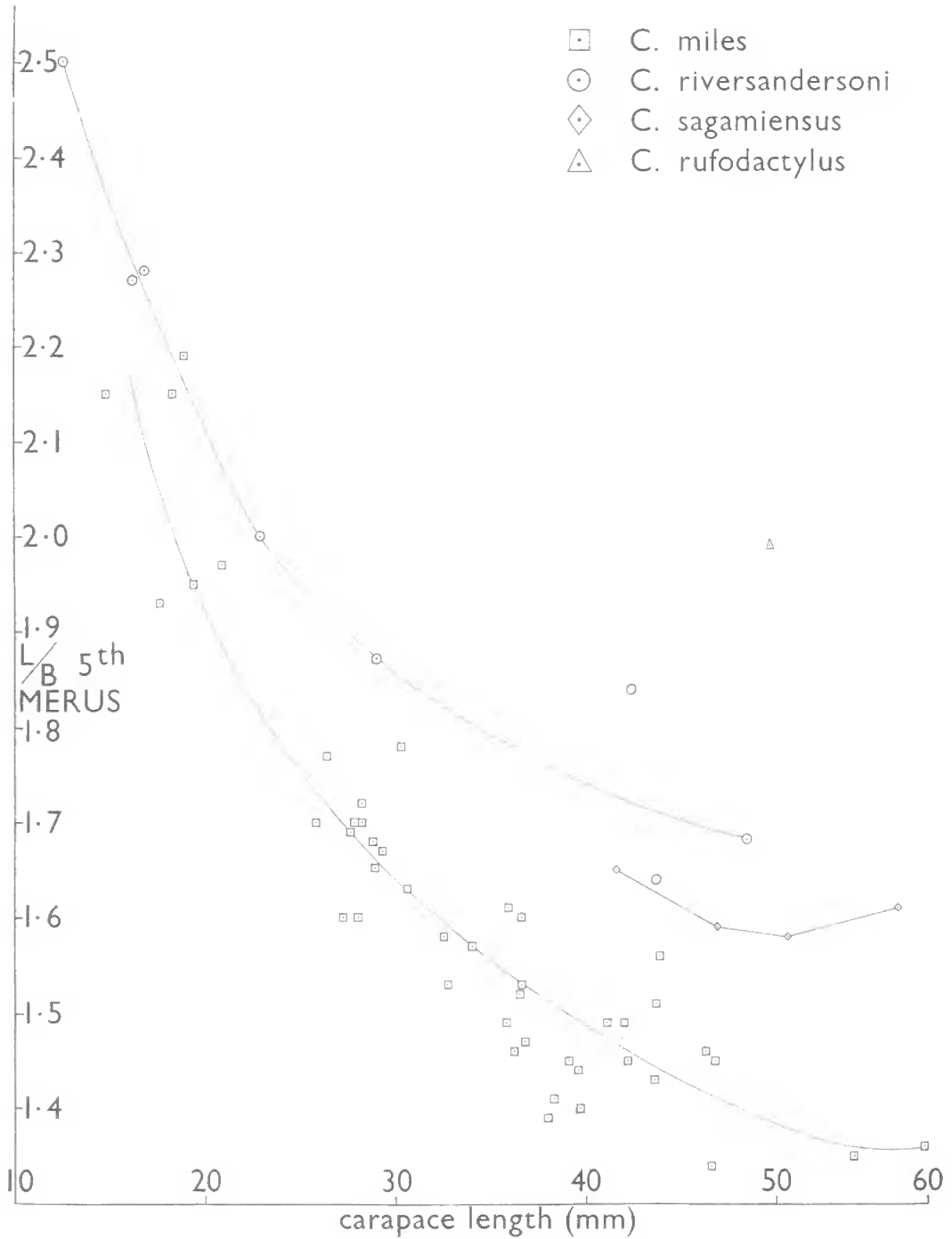


FIG. 3: L/B ratios of merus of fifth leg plotted against carapace length. Each point represents a single individual, and when two meri are present the L/B ratio is the mean. Curves through the *C. miles* and the *C. riversandersoni* data have been smoothed visually.

ANTEROLATERAL TEETH: Six; first short and narrow with truncate margin; second to fifth broad-based, sharp-tipped, with anterior borders concave, and with second relatively short particularly its tip, third and fourth relatively broad, fifth relatively sharp and protruding. Sixth sharp, of moderate length and directed laterally and a little upwards.

CARAPACE: Relatively broad (mean B/L 1.54), without hairs, feebly developed granular ridges, granular patches not present. Posterolateral borders short and much inclined. Postlateral junction rounded. Branchial regions swollen. Finely granular ridges as follows: protogastrics short, very widely separated, slightly convex anteriorly; mesogastrics almost straight; metogastrics very widely separated in midline and barely recognisable; epibranchials fairly conspicuous, moderately curved. Posterior part of cervical grooves deep, narrowly separated, distant from metagastric ridges.

CHELIPEDS: Long, spinous, upper surfaces smooth, hand swollen. Arm with anterior border bearing 3–4 spines (four in larger specimens) which are curved, sharp, and either slender or robust; upper and under surfaces smooth and polished; under surface terminating distally in boss with tubercle or spine. Wrist with inner and three outer spines; inner spine short and stout; obscure carina running to inner spine, carinae running to upper and lower of the three outer spines. Hand with four short, robust spines, including one at wrist articulation, one near centre of outer margin, and two on inner margin, one roughly at middle, one on distal border; outer surface with central carina a low rounded ridge, above this faint squamiform markings; under surface smooth; inner surface with carina a rounded ridge often indistinct proximally, above and below carina smooth. Movable finger long, slender, moderately deeply grooved. Immobile finger with inner and outer surfaces as movable finger; under surface smooth and rounded.

WALKING LEGS: Moderately slender, for example carpus of last walking leg relatively elongate.

FIFTH LEG: Merus elongate (see fig. 3); spine on posterodistal border. Propodus with 0–4 spinules on posterodistal border.

MALE ABDOMEN: Penultimate segment broader than long, sometimes slightly so, sometimes very much so. Ultimate segment relatively elongate.

MALE FIRST PLEOPOD: Sinuous, without obvious membrane. Subterminal armature: inner side, short bristles to aperture; outer side, elongate row of moderately short bristles.

PIGMENTATION (recently preserved specimens): Features common to all four species are separately listed (see p. 106). Distinctive features are:—movable finger, upper and inner surfaces, proximal half cream, distal half pink; outer surface, distal half to two-thirds cream, remainder pale pink. Immobile finger, outer surface, proximal two-thirds cream, distal one-third pale pink, pigment extending backwards on under surface but not to level of articulation of movable finger; inner surface, proximal one-third to half entirely cream with sharp oblique separation from pink distal area.

COMMENTS

This species is close to *C. sagamiensis* and the resemblances are detailed in the Discussion. Distribution is Gulf of Oman, East Coast of India, and South China Sea.

Charybdis sagamiensis Parisi

(Figs. 1C, 1G, 2C, 2E; pl. 12C)

Charybdis sagamiensis Parisi, 1916, p. 175, pl. 11, fig. 1.

Charybdis riversandersoni Alcock. Balss, 1922, p. 105. Sakai, 1939, pp. 404–5, pl. 46, fig. 1; 1965, pp. 122–3, pl. 60, fig. 2.

[non] *Charybdis* (*Goniosoma*) *riversandersoni* Alcock.

MATERIAL EXAMINED

From Dr. T. Sakai: Male (61.5 mm)†, female (73.5 mm), coast of Mikawa, central Japan, 30–50 m., † Qd Mus., W2785.

From Museum National d'Histoire Naturelle, Paris: Male (78 mm)*, Japon, Frank (? ifs), 1895; male (85.5 mm), Viet Nam, Campagne du "de Sanessa", don. Mr. Krempf, 1925–1926.

From British Museum: 2 females (35.5, 41 mm), Tosa Bay, Japan, K. Sakai, 1961, 6.5.61/62.

The following specimen may belong to the above species.

From Smithsonian Institution, U.S.N.M.: Male (62.5 mm), Misaki, Japan, A. S. Pearse (don.), brought from Kuma-san, 1930, 63679 (prev. ident. M. J. Rathbun as *C. miles*).

MATERIAL ILLUSTRATED

Pl. 12C and Figs. 1C, 1G and 2C, specimen * above; Fig. 2E, specimen † above.

DESCRIPTION

FRONT: Six toothed, with medians and submedians relatively stout and triangular (apparently sharp-tipped when undamaged), laterals narrow, elongate and acute. Medians separated by deep fissure, pointing directly forwards and slightly narrower than submedians. Submedians separated from medians by moderately deep fissure, inclined slightly laterally, mostly their inner borders. Laterals separated from submedians by relatively deep fissure, pointing directly forwards. Inner supraorbital angles sharp. Inner supraorbital fissure narrowly open, outer fissure barely open. General suborbital border granular. Suborbital fissure wide.

ANTEROLATERAL TEETH: Six; first relatively short with truncate or almost bifid margin; second to fifth broad-based, sharp-tipped with anterior borders distinctly concave and with third and fourth slightly larger than second and fifth. Sixth sharp, relatively long, curved forwards and upwards.

CARAPACE: Relatively broad (mean B/L 1.53), without hairs, with well developed granular ridges, general surface with fine diffuse granular patches. Posterolateral borders short and much inclined. Postlateral junction rounded. Branchial regions at most faintly swollen. Granular ridges as follows: protogastrics fairly short, very widely separated, slightly convex anteriorly; mesogastrics almost straight; metogastrics moderately separated in midline, almost straight; epibranchials conspicuous, curved. Fine diffuse granular patches on unworn specimens as follows: on bases of frontal teeth; between protogastrics and mesogastrics; just behind inner terminations of epibranchial ridges; very fine granules on bases of first to fifth anterolateral teeth. Posterior part of cervical grooves moderately deep, fairly widely separated, distant from metagastric ridges.

CHELIPEDS: Massive, spinous, upper surfaces mostly hairless, hand swollen. Arm with anterior border bearing 3–4 spines which are curved, sharp and robust; upper surface mostly very finely granular; under surface smooth, terminating in boss with spine or tubercle. Wrist with inner and three outer spines, inner spine of moderate length and sharp; carinae running to inner spine and to upper and lower of three outer spines. Upper surface of hand with four sharp, stout spines including one at wrist articulation, one near centre of outer margin, and two on inner margin, one roughly at middle, one on distal border; outer surface with central carina a rounded ridge, above this recognisable squamiform markings; under surface with hint of squamiform markings; inner surface with central carina a rounded ridge, above and below carina smooth. Movable finger relatively short and stout, moderately deeply grooved in smaller specimens and shallower grooves in larger specimens. Immobile finger with inner and outer surfaces as movable finger; under surface smooth and rounded.

WALKING LEGS: Moderately robust, for example carpus of last walking leg relatively short and broad.

FIFTH LEG: Merus of moderate length (see fig. 3); spine on posterodistal border. Propodus with 0–2, typically 2, spinules on posterodistal border.

MALE ABDOMEN: Penultimate segment of variable width and always broader than long. Ultimate segment of moderate length.

MALE FIRST PLEOPOD: Sinuous, without obvious membrane. Subterminal armature: inner side, bristles to aperture, sometimes inconspicuous in profile view; outer side, concentration of bristles behind tip thereafter sparse row of variable length, short (1 specimen) or long (2 specimens).

PIGMENTATION (recently preserved specimens): Features common to all four species are separately listed (see p. 106). Distinctive features are: movable finger, upper, inner and outer surfaces, proximal half pale pink and white, distal half red. Immobile finger, outer surface, proximal half pale pink, sharply demarcated from distal half red, no backwards extension of red pigment in side view; inner surface, proximal one-third to half mostly cream with oblique separation from pink distal area.

COMMENTS

This species is close to *C. riversandersoni* and the resemblances are detailed in the Discussion. Distribution is Viet Nam to Japan.

***Charybdis rufodactylus* n. sp.**

(Figs. 1D, 1H, 2F; pl. 12D)

MATERIAL EXAMINED AND ILLUSTRATED

Holotype: Male (75.5 mm), (dried), trawled 100 fm off Cape Moreton, southern Queensland, L. Wale, June 1964, don. Zool. Dept Univ. Qd, Qd Mus. W2573.

DESCRIPTION

FRONT: Six very acute, pointed teeth. Medians broader than submedians and separated by deep angular fissure, pointing slightly outwards; submedians separated from medians by broad, deep fissure, inclined slightly outwards, particularly their inner borders which are concave. Wide and deep incision between submedians and laterals which are long, thin and inclined directly forwards. Inner supraorbital angles sharp and acutely pointed. Inner supraorbital fissure narrowly open; outer fissure barely open. General suborbital border granular. Suborbital fissure wide.

ANTEROLATERAL TEETH: Six, first relatively short with almost bifid margin; second to fifth broad-based, very sharp-tipped with anterior borders distinctly concave, becoming sharper and more slender from second to fifth. Sixth sharp, relatively long, directed outwards and slightly upwards.

CARAPACE: Relatively broad (B/L 1.51), with fine pile visible in postlateral portions, with well-developed granular ridges, also with granular areas. Posterolateral borders short and much inclined. Postlateral junction rounded. Branchial regions at most faintly swollen. Granular ridges as follows: frontals short but conspicuous; protogastrics fairly short, widely separated, convex anteriorly; mesogastrics sinuous, bow-shaped; metogastrics with fairly narrow separation in midline and forming a shallow arc concave anteriorly; epibranchials very conspicuous, curved; faint longitudinal ridge in midline from protogastrics to behind mesogastrics. Granular patches as follows: behind frontal ridges; relatively coarse granules, between protogastrics and mesogastrics; relatively fine, just behind inner terminations of epibranchial ridges;

diffuse patches in mesobranchial and cardiac areas; fine granules on bases of first to fifth anterolateral teeth, with patches on bases of second teeth the largest. Posterior part of cervical grooves deep, widely separated, distant from metagastric ridges.

CHELIPEDS: Long, spinous, upper surfaces sparsely hirsute, and slightly swollen, left slightly larger than right. Arm with anterior border bearing four spines which are curved, sharp and moderately robust; upper surface mostly coarsely granular; under surface smooth terminating in boss with sharp spine. Wrist with inner and three outer spines; inner spine of moderate length and sharp; carinae running to inner spine and to upper and lower of three outer spines. Upper surface of hand with four sharp, long spines including one at wrist articulation, one near centre of outer margin, and two on inner margin, one roughly at middle, one on distal border, carinae leading to inner and outer central spines, granular; outer surface with central carina a conspicuous ridge, above this distinct squamiform markings; under surface with hint of squamiform markings; inner surface with conspicuous central carina with a hint of squamiform markings above and below carina. Movable finger long, slender, deeply grooved. Immobile finger with inner and outer surfaces as in movable finger; under surface with shallow grooves.

WALKING LEGS: Moderately robust, for example carpus of last walking leg relatively short and broad.

FIFTH LEG: Merus elongate (see fig. 3); spine on posterodistal border. Propodus without spinules on posterodistal border (only one propodus available).

MALE ABDOMEN: Penultimate segment broader than long. Ultimate segment of moderate length.

MALE FIRST PLEPOD: Sinuous, without obvious membrane. Subterminal armature: inner side, short but conspicuous bristles to aperture; outer side, relatively long row of long bristles.

PIGMENTATION (recently preserved specimen): Features common to all four species are separately listed (see p. 106). Distinctive features are: movable finger, upper, inner and outer surfaces, proximal one-third mostly pale pink, distal two-thirds red. Immobile finger, outer surface proximal one-third cream, distal two-thirds red, this extending slightly backwards, but not to level of articulation of movable finger; inner surface, proximal one-quarter to one-third mostly cream, with oblique separation from pink distal area.

COMMENTS

This species differs considerably from the remainder, and possesses the following distinctive features apart from pigmentation:

- (1) Frontal teeth very acute and pointed, medians separated by deep angular fissure, separated from submedians by broad deep fissure.

- (2) Inner supraorbital angles sharp and acutely pointed.
- (3) Anterolateral teeth generally, very sharp-tipped, becoming sharper and more slender from second to fifth.
- (4) Relatively conspicuous but short frontal ridges.
- (5) Mesogastric ridges sinuous and almost bow-shaped.
- (6) Metagastric ridges forming shallow arc concave anteriorly.
- (7) Cheliped hand with long spines on upper surface.
- (8) Cheliped, immovable finger, under surface with shallow grooves.
- (9) Male first pleopod, subterminal armature, outer side relatively long row of long bristles.

It is known only from the type locality.

DISCUSSION

The four species belong to the subgenus *Charybdis* de Haan, 1833, in the sense used by Leene (1938, p. 18). Leene listed the characteristic features as:—

- (1) Whole of external angle of basal antennal joint joins the front and excludes flagellum from the orbit.
- (2) Margin of posterior border of cephalothorax forms a curve with posterolateral borders.
- (3) Six anterolateral teeth (seven if one is a small spine).
- (4) No spine on posterior border of arm of cheliped.
- (5) Four median frontal teeth not very dissimilar from lateral frontal teeth. This does not strictly apply to the present species in which the lateral teeth are narrower and more pointed than the medians or submedians. Because the affinities of the species are clearly with the other species of this "subgenus", it is best to eliminate this as a characteristic feature.

All species are without transverse ridges on the carapace behind the last anterolateral teeth and the first tooth is more or less truncate. This brings them into an eight species "assembly" which includes *C. feriatus* (L., 1758) = *C. cruciata* (Herbst), *C. japonica* (A. Milne Edwards, 1861), *C. affinis* Dana, 1852, and *C. rosaea* (Jacquinot, 1852).

Leene separated these species primarily on the number of spines on the anterior border of the arm. In the present species this has been shown to be variable, and a different basis for separation is required. The number of spines upon the hand is a convenient keying feature, with five species having four spines including that at wrist articulation (present four species and *C. feriatus*), two species having five spines (*C. japonica* and *C. affinis*) and one species having three spines (*C. rosaea*).

C. rosaea differs in numerous other respects from the remainder including a very narrow carapace, few spines on anterior border of arm of cheliped, and very short meri of fifth legs.

C. affinis and *C. feriatus* differ in several respects from the remainder including more swollen hands of chelipeds, smaller spines on chelipeds, more rounded and broader lateral frontal teeth, and broader and less claw-like second to fifth anterolateral teeth. However *C. feriatus* shows certain resemblances to *C. riversandersoni* including smoothness of carapace and relative inconspicuousness of its granular ridges.

Meanwhile *C. japonica* is reasonably close to *C. miles*, sharing with it a pilose carapace and chelipeds, relatively acute frontal teeth, meri of the fifth legs of approximately similar proportions and somewhat similar male first pleopods. In addition to having five instead of four spines on the upper surface of the hand of the cheliped, *C. japonica* has three as against four spines on the anterior border of the arm, relatively narrow median frontal teeth which are orientated forwards, relatively broader carapace, relatively smaller first anterolateral teeth, and stouter walking legs.

Apart from the "subgeneric" features, and those of the eight species "assembly" the features common to the four present species are:—

FRONT: Submedian teeth inclined laterally, lateral teeth more pointed and narrower than medians and submedians, outer supraorbital fissure barely open, general suborbital border granular.

ANTEROLATERAL TEETH: First relatively short with truncate, sometimes almost bifid margin; second to fifth broad-based, sharp-tipped, with anterior borders concave.

CHELIPEDS: Spinous, hand at least slightly swollen. Arm with anterior border bearing 3–5 sharp, curved spines. Under surface terminating distally in boss with spine or tubercle. Wrist with well-developed inner spine and in unworn specimens three outer spines; carinae run to inner spine and to upper and lower of the three outer spines. Upper surface of hand with four spines including one at wrist articulation, one near centre of outer margin, and two on inner margin, one roughly at middle, one on distal border; outer surface with distinct central carina and above this at least a tendency to squamiform markings.

FIFTH LEG: Spine on posterodistal border of merus.

THIRD MAXILLIPED: Anteroexternal angle of merus distinctly expanded in lateral direction.

MALE ABDOMEN: Penultimate segment broader than long. Ultimate segment triangular with rounded tip.

MALE FIRST PLEOPOD: Sinuous, without obvious membrane. Subterminal armature on inner side with bristles to aperture.

PIGMENTATION (in recently preserved specimens): Carapace with light area in postlateral regions. Cheliped, upper surfaces of arm and hand pink with light mottling; outer surface of hand with vertical pink bars reminiscent of squamiform arrangement of granules; fingers, distal halves of inner surfaces of movable and immovable fingers pink or red; ends of fingers mostly dark brown with paler tips.

All the above features were included in the specific descriptions except the colour features held in common.

Of the four species *C. miles* and *C. rufodactylus* are each distinguished by numerous features as listed and are not likely to be confused. On the other hand *C. riversandersoni* and *C. sagamiensis* resemble each other in numerous features as follows:—

- (1) Median and submedian frontal teeth relatively stout.
- (2) Median frontal teeth separated by moderately deep to deep fissure, pointing directly forwards, and slightly narrower than submedians.
- (3) Carapace relatively broad and hairless.
- (4) Branchial regions of carapace at least faintly swollen.
- (5) Posterior part of cervical grooves distant from metagastric region.
- (6) Chelipeds, arm, with under surface smooth.
- (7) Chelipeds, hand, with carinae on inner and outer surfaces rounded ridges.
- (8) Chelipeds, hand, inner surface smooth above and below carina.
- (9) Chelipeds immovable finger, inner and outer surfaces moderately deeply grooved, undersurface smooth and rounded.

C. riversandersoni and *C. sagamiensis* differ in:—

- (1) Median and submedian frontal teeth less sharply triangular in *C. riversandersoni*.
- (2) Fissure between median and submedian frontal teeth broader in *C. riversandersoni*, deeper in *C. sagamiensis*.
- (3) Submedian frontal teeth more inclined laterally in *C. riversandersoni*.
- (4) Fissure between submedian and lateral frontal teeth broader in *C. riversandersoni*, deeper in *C. sagamiensis*.
- (5) Inner supraorbital angles stouter in *C. riversandersoni*.
- (6) Inner supraorbital fissure more widely open in *C. riversandersoni*.
- (7) First anterolateral tooth narrower in *C. riversandersoni*.
- (8) Anterolateral teeth, with second relatively short, third and fourth relatively broad, fifth relatively sharp and protruding in *C. riversandersoni*.

- (9) Sixth anterolateral tooth shorter and less upwardly directed, and curved forwards in *C. riversandersoni*.
- (10) Branchial regions of carapace more swollen in *C. riversandersoni*.
- (11) Carapace ridges less strongly developed in *C. riversandersoni*.
- (12) In *C. riversandersoni* metagastric ridges very widely separated in midline and barely recognisable; in *C. sagamiensis* metagastriacs moderately separated in midline, and almost straight.
- (13) Epibranchial ridges less conspicuous and less curved in *C. riversandersoni*.
- (14) Smooth carapace in *C. riversandersoni*, fine diffuse granular patches present on carapace in unworn specimens of *C. sagamiensis*.
- (15) Posterior part of cervical grooves deeper and less widely separated in *C. riversandersoni*.
- (16) Chelipeds, less massive in *C. riversandersoni*.
- (17) Chelipeds, upper surfaces hairless in *C. riversandersoni*, with few hairs in *C. sagamiensis*.
- (18) Chelipeds, arm, upper surface smooth in *C. riversandersoni*, mostly very finely granular in *C. sagamiensis*.
- (19) Chelipeds, wrist, inner spine stouter in *C. riversandersoni*.
- (20) Chelipeds, wrist, carina running to inner spine more obscure in *C. riversandersoni*.
- (21) Chelipeds, hand, outer surface above carina with less conspicuous squamiform markings in *C. riversandersoni*.
- (22) Chelipeds, hand, under surface smooth in *C. riversandersoni* as against with faint squamiform markings in *C. sagamiensis*.
- (23) Chelipeds, movable finger longer and more slender in *C. riversandersoni*.
- (24) Walking legs relatively more slender in *C. riversandersoni*.
- (25) Fifth leg, merus more elongate in *C. riversandersoni*.
- (26) Male abdomen ultimate segment relatively longer in *C. riversandersoni*.
- (27) Male first pleopod: outer side without concentration of bristles just behind tip in *C. riversandersoni*.

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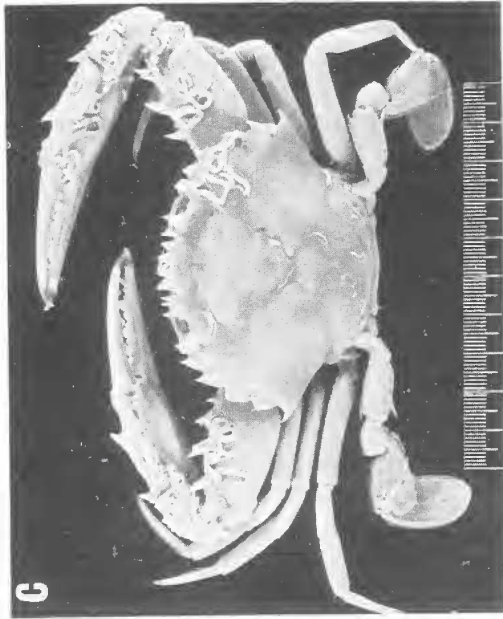
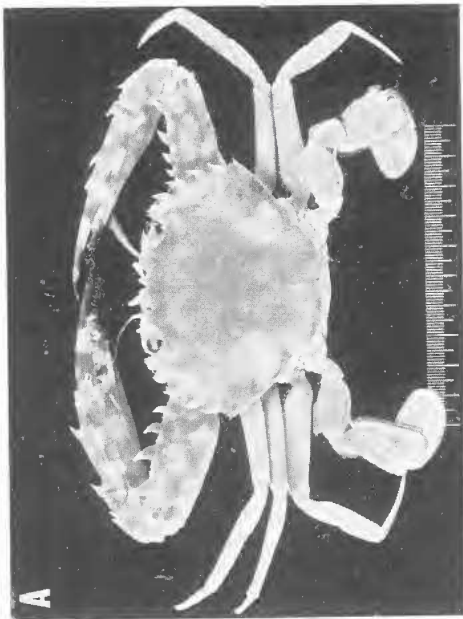
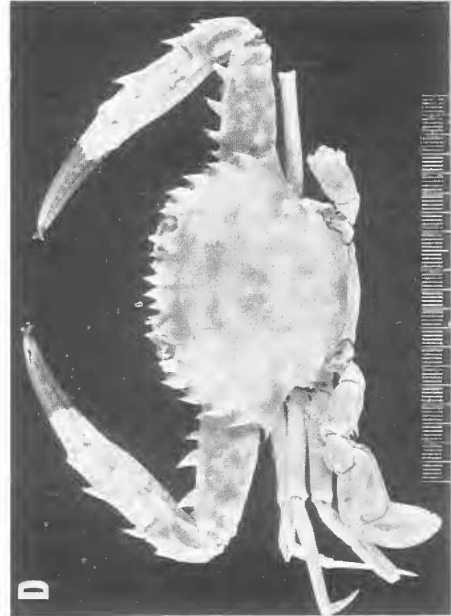
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PLATE 12

Dorsal views. Scale 1 div. = 1 mm.

- A. *Charybdis miles*
- B. *C. riversandersoni*
- C. *C. sagamiensis*
- D. *C. rufodactylus*



C